

DISSIPATION AND CONSEQUENT POSSIBLE
DERMAL EXPOSURE HAZARDS OF DDVP AND PROPOXUR ON
HORIZONTAL SURFACES FOLLOWING THE RELEASE OF
INSECTICIDE WITH AN INDOOR FOGGER

By

Keith T. Maddy, Chief/Staff Toxicologist
Kean S. Goh, Environmental Hazards Specialist
Sue Edmiston, Environmental Hazards Specialist III
Sheila Margetich, Agricultural Chemist I

HS-1334 Revised November 20, 1987

California Department of Food and Agriculture
Division of Pest Management Environmental
Protection and Worker Safety
Worker Health and Safety Branch
1220 N Street Sacramento, California 95814

SUMMARY

Following the label directions of one product with specific instructions for two hours of undisturbed fogging and then one hour of aeration prior to reentry, treatment of rooms with an insecticidal indoor fogger containing 1.00% propoxur and 0.5% DDVP resulted in floor residues of DDVP that were above an estimated (maximum) safe level until eight hours after treatment and at least 48 hours (end of sampling period) for propoxur. Estimated safe levels used in this study were calculated for adult workers exposed to dislodgeable residues on growing plant leaves (foliar) of DDVP (0.06 ug/cm^2) and propoxur (3 ug/cm^2). Extrapolation of data on foliar surfaces to flat floor or rug surfaces was done in lieu of more appropriate information to estimate exposure of crawling infants.

INTRODUCTION

Indoor room foggers are readily available insecticide dispensers to be used in the home to kill fleas, roaches, ants, spiders, ticks, mosquitoes, flies, flying moths and silverfish. In January 1985, in California there were at least 62 fogger products registered by 20 firms, containing 13 active ingredients either singular or in various combinations.

During 1983, in the Los Angeles area alone, there were 233 reported cases of either possible exposure to indoor fogger insecticides or calls seeking information regarding fogger safety especially to infants and pets and residue on exposed foods (1)(Table I). The fogger used in this current study contains two moderately to highly toxic active ingredients as a very low percentage of the product; 0.5% DDVP (2,2-dichlorovinyl 0,0-dimethyl phosphate, CAS #62-73-7) and 1.0% propoxur (0-isopropoxy phenyl N-methylcarbanate, CAS #114-26-1).

The potential hazards and reported illnesses prompted two previous studies to determine if the 30-minute aeration period prescribed on many of the labels was sufficient to allow safe reentry into a room or home. There was concern regarding exposures especially to infants, the elderly and those who are ill, as well as healthy adults who might occupy treated rooms almost 24 hours per day (2)(3). A few new indoor fogger labels recommend ventilation for an hour instead of 30 minutes before reentry and read "Do not use in any room where infants, the sick, or the aged are, or will be present for an extended period of confinement."

Following some of the new label directions, this study was conducted to determine the dissipation of DDVP and propoxur from horizontal surfaces (fallout pads) following the release from an indoor fogger. Because previous studies in homes gave highly variable data, this trial was carefully replicated in an emptied, unoccupied apartment. It was determined not to simultaneously study dissipation of air levels of these chemicals.

MATERIALS AND METHODS

The trial was conducted in an empty two bedroom apartment with wall to wall shag carpet in Davis, California on January 2, 1985.

A widely marketed brand of home fogger containing 0.5% DDVP and 1.0% propoxur as purchased from a local supermarket. Three six ounce cans were used for a formulation check. A six ounce (170g) can was set on folded newspaper in the center of the master bedroom and guest bedroom. A fourteen ounce can (397gr) was similarly employed in the living room. The actual net content discharged was determined by weighing the full and discharged can. Twenty-six pieces of heavy duty aluminum foil (10 x 10 cm) serving as fallout collecting pads were placed horizontally on the carpet surface midway between the fogger and the walls in all three rooms. Immediately, before activation of the foggers two pads were removed from each room to serve as background samples. Following label directions, all doors and windows were closed, cabinets and doors opened and the furnace was turned off. The foggers were activated by holding the fogger at arm's length pointing can away from the face and eyes. The activated can was set in the

upright position and allowed to completely discharge. Two randomly selected fallout pads, from each room, were removed immediately post actuation, and at 15 minutes, 30 minutes, one hour and two hours post-fogging. During this sampling period protective clothing, goggles and respirator was worn by the investigator. After two hours, all windows and doors were opened and the room was allowed to ventilate for one hour. Sampling continued at 3, 4, 6, 8, 12, 24 and 48 hours post-application.

Residues of DDVP and propoxur were analyzed and expressed as micrograms/square centimeter ($\mu\text{g}/\text{cm}^2$) and dissipation curves were plotted.

RESULTS AND DISCUSSION

There were no significant differences ($P>0.01$) between actual and label claims of the active ingredients and the net content of indoor fogger (Table II, III, IV). Based on actual weight of material discharged, the maximum theoretical amounts of DDVP and propoxur that could possibly be deposited on the floor surface were calculated and compared to the actual maximum residues detected at any one time in samples collected during 0-15 minute period after actuation. Table V showed the close agreement between actual and theoretical amount deposited indicating that a large proportion of the chemicals do settle on the floor surface vs the walls surfaces. Hence floor fallout pad samples are a good measure and indicator of chemical deposit following actuation of an indoor fogger.

Figures 1 and 2 showed the dissipations of DDVP and propoxur, respectively, under winter test conditions where mean room temperature was 42°F (5.6°C), ranging from 32 to 54°F , and relative humidity was 79%. Under such test conditions, even with an hour of aeration after a two hour fogging period, approximately eight hours elapsed before DDVP dissipated to the estimated (maximum) safe level of $0.06 \mu\text{g}/\text{cm}^2$ (Figure 2). Propoxur did not fall below the estimated (maximum) safe level of $3 \mu\text{g}/\text{cm}^2$ (personal communication J. Knaak Toxicologist, CDFA, Feb. 10, 1985) through the end of sampling period at 48 hours. However, these estimated (maximum) safe levels were calculated for dislodgeable residues of tree and row crop foliage, where the entire person's body might be exposed. Hence, extrapolation of these levels might only be appropriate for exposure by persons laying on the floor, crawling, playing or engaged in activities that result in most of the body surface coming in contact with chemical residues on the floor. This would not necessarily preclude activity like walking when shoes are worn.

The residual levels of propoxur lying on horizontal surfaces could pose hazards for at least up to 48 hours after application. The label directions of the product used did attempt to address this problem by stating "Do not use in any room where infants, the sick or aged are, or will be present for an extended period of confinement."

Other studies have suggested that excessive air-borne levels, at least of DDVP, would be close to the floor for a number of hours after application. This hazard would need to be factored in.

More recently, chronic effects (cancer) data on animal studies on DDVP have raised additional concerns about exposure to this chemical.

An additional factor that needs to be considered with foggers is the possible presence of solvents and other "inerts" that may be of toxicological concern.

TABLE 1

Telephone Calls Concerning Exposure to
Indoor Foggers and For Information Handled by
the Los Angeles County Medical Association
Regional Poison Information Center
January through December 1983

January	6
February	6
March	8
April	10
May	16
June	24
July	50
August	27
September	32
October	29
November	17
December	8
Total	233

TABLE 2

Mean Label Claim vs Actual Percentage Found
of the Indoor Room Fogger Used

Content	Claim	Found
Net wt.	170 gm	171.8 gm
DDVP	0.47%	0.43%
Propoxur	1.00%	1.04%
Pyrethins	0.10%	ND
Piperonyl Butoxide	0.50%	ND
MGK 264 Synergist	0.50%	ND

ND = Not determined

TABLE 3

Contents of Room Foggers Label Claim vs Actual Amount Discharged
in January 1985 Dissipation Studies

Expt.	Room	Actual Wt. discharged (gm)	Label claim(gm)	can size (oz.)
Fallout Pad Surface	Master Bedroom	168.03	170	6
	Guest Room	173.33	170	6
	Living Room	395.11	397	14
Air	Master Bedroom	170.51	170	6
	Guest Room	174.15	170	6
	Living Room	393.40	397	14

TABLE 4

ANOVA of Actual Material Discharged vs Label Claim
of Room Foggers (Table 3 Data)

Source of Variation	Degrees of Freedom (df)	Sum of Square (ss)	Mean Square (ms)	Observed F	Required F 1%
Total	7	27.92			
Foggers	1	4.53	4.53	1.16	13.75
Error	6	23.39	3.89		

TABLE 5

Maximum Theoretical vs Maximum Detected Deposits of DDVP
and Propoxur as Collected On Aluminum Fallout Pads
Laid Out on the Floor of Emptied Rooms in an Apartment,
Davis, California - January 1985

Room	Total DDVP Discharged (gm)	Floor Surface (cm ²)	Maximum Theoretical (ug/cm ²)	Maximum Detected (ug/cm ²)
Master Bedroom	0.789	164,502	5.14	5.97
Guest Room	0.815	118,872	6.86	6.82
Living Room	1.857	367,642	5.05	5.64

Room	Total Propoxur Discharged (gm)	Floor Surface (cm ²)	Maximum Theoretical (ug/cm ²)	Maximum Detected (ug/cm ²)
Master Bedroom	1.680	164,502	10.21	14.31
Guest Room	1.733	118,872	14.58	15.53
Living Room	3.951	367,642	10.75	14.86

REFERENCES

1. Richmond, D. R. Pesticide Exposure and Information Calls Handled by the Los Angeles County Medical Association Regional Poison Information Center January - December 1983, CDFA report, HS-1111 and subsequent HS reports for 1983.
2. Maddy, K. T., S. Edmiston and A. S. Fredrickson. 1981. Monitoring Residues of DDVP in Room Air and On Horizontal Surfaces Following Use of A Room Fogger, CDFA report, HS-897.
3. Maddy, K. T., S. Edmiston and E. Ochi. 1984. Dissipation of DDVP and Propoxur Following the Release of An Indoor Fogger - A Preliminary Study CDFA report, HS-1259.

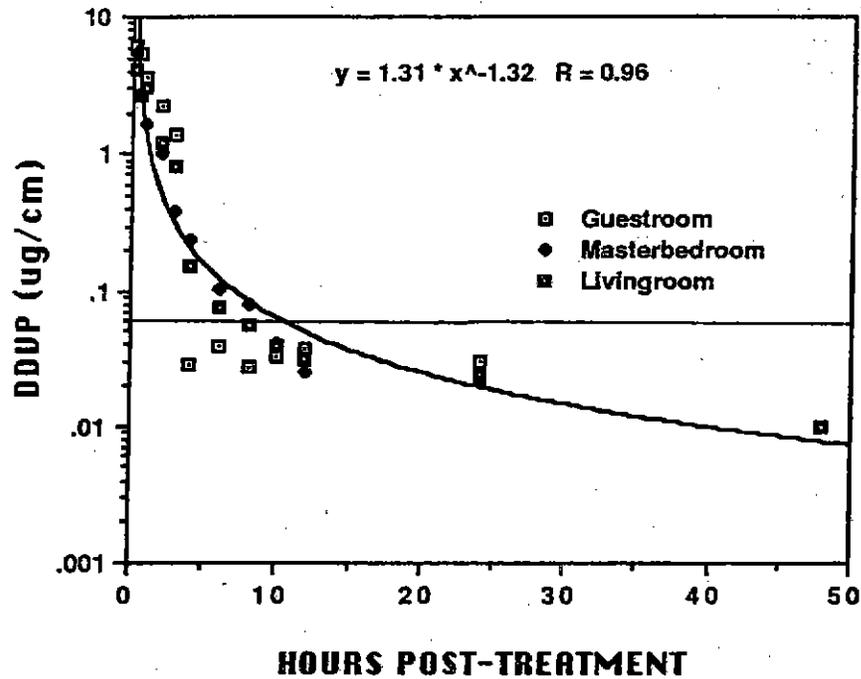


Figure 1: Regression for the dissipation of dislodgeable DDVP residue on horizontal surfaces as collected on aluminum foil and analysed at various time intervals after the release of a room fogger for each room, January 2, 1985. Horizontal line at 0.06 ug/cm² is the estimated safe level.

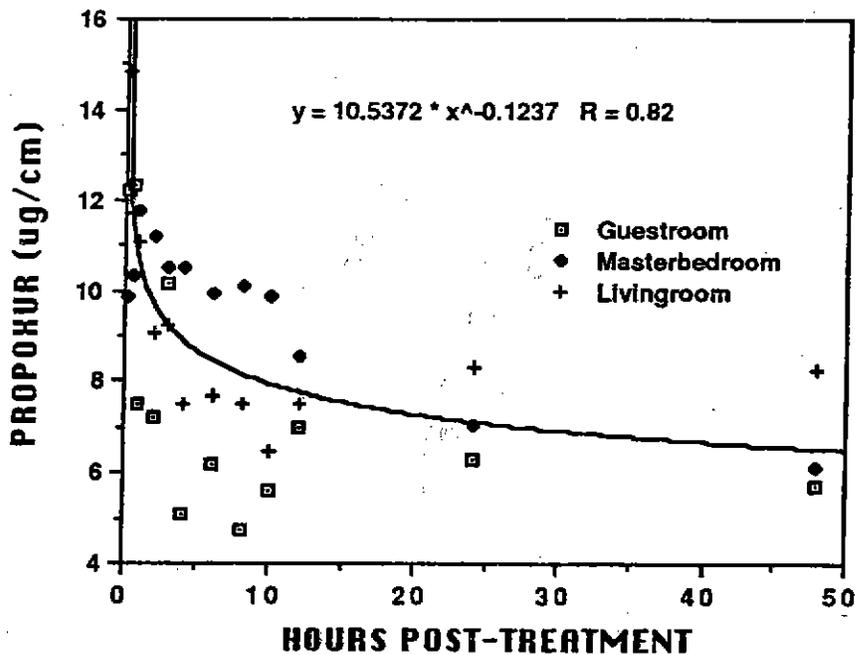


Figure 2: Dissipation of propoxur from horizontal surfaces as collected on aluminum foil and analysed at specified time intervals after the release of a room fogger, January 2, 1985.